Frictional Adhesive Contact between Deformable Solids

+ An atomistically-inspired contact model
A simple contact model is developed to capture the evolution of area and load in frictional adhesive contacts under mixed-mode loading. The method relies on Green's function molecular dynamics to calculate the elastic fields in the bodies. The interface interactions are modelled through sets of “springs” that connect the surface nodes, mimicking the interatomic interactions. The reduction in the contact area during shear loading is found to be well fitted (solid black lines) by the empirical quadratic law from a recent experiment:

Connecting the points marking the contact area at the maximum tangential contact force determines the law of onset of sliding. This is demonstrated here for three cases with various adhesion and friction properties:

In all cases, the points marking the onset of sliding related to various normal loading align well on a straight line. Slope of these lines represent the contact shear strength.

+ Rough surfaces in adhesive contact
The relative contact area versus reduced pressure (pressure normalized by elastic modulus and root-mean-square gradient) for a self-affine rough rigid solid indenting an initially flat almost incompressible solid is presented here:

In the presence of adhesion, due to the attraction between surfaces, the deformable solid conforms better to the random rough rigid profile, particularly to the finer features of the roughness.

+ Key publications